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ABSTRACT

As a first step in developing a research program that united several individual strands of comprehension research, this paper describes studies that relate to the effectiveness of direct instruction. Various sections of the paper discuss the following topics: (1) variables in the direct instruction model, (2) teacher performance variables, (3) instructional design variables, (4) teaching component skills, and (5) limiting cases for strategy practice and feedback. Overall findings reported in the paper suggest that direct instruction provides a framework for analyzing comprehension instruction in terms of teaching techniques, text structures, metacognitive strategies, and specific skills. (CRH)

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The Effectiveness of Direct Instruction in Teaching Selected Reading Comprehension Skills

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A reader approaches a text with a broad range of skills, attitudes, and background knowledge. The text she or he confronts takes many forms, varying in organizational, informational, syntactic, semantic, and graphic complexity. Possible interactions between text and reader variables are myriad. Students may also lack essential meta-cognitive strategies; (e.g., knowing when a passage isn't making sense and what to do to understand it or identifying and rehearsing information so that it won't be forgotten). Students may also lack specific skills (like drawing inferences based on scientific rules or transforming passive voice constructions). Learner and text variables do not exhaust the cast of characters. The way a student treats a passage is often mediated by the teacher and possibly other students.

The research community has responded to the complexity of reading comprehension by identifying strands of related topics and conducting research within each strand. Some of the more prominent strands involve: (1) meta-cognitive strategies (e.g., Brown, Campione & Day, 1981), (2) specific comprehension skills (e.g., Cohen & Stover, 1981), (3) text structure (e.g., Beck, Omanson, & McKeown, 1982; Mever, Brandt, & Bluth, 1980), and (4) attributes of effective teaching (e.g., Stevens & Rosenshine, 1981). The recent surge of research within each of these strands has yielded a comparative explosion of findings with implications for practitioners (Pearson, in press). The limitation of research parcelled out into disparate strands is discontinuity across strands. The problems in integrating findings from these discrete strands of research cannot be overcome with a few grand experiments, each with three levels of independent variables, with perhaps a student ability variable thrown in. A more modest approach might be to design studies around

a particular theoretical perspective, which would make an integration of findings from these disparate strands possible, if not easy. The purpose of the present paper is to describe an initial attempt at such an approach. Our interest in developing a research program bridging several individual strands of comprehension research grew out of our fieldwork with the Direct Instruction Follow Through Model, originated by Siefgried Engelmann and Wesley Becker in 1968. Working to improve reading instruction in 20 school districts in seventeen states, the project staff were constantly making decisions about how to teach reading to economically disadvantaged students. These decisions shaped the structure of the reading texts used by the students, the comprehension strategies presented to the students, and the presentation techniques employed by the teachers. While researchers may treat these topics as separate strands, practitioners play them in concert.

The actual decision to begin conducting programmatic research on comprehension was fostered by the documented success of the Direct Instruction Model in increasing the Reading Comprehension scores of economicaly disadvantaged students in the primary grades (Stebbins et al., 1977; Gersten, 1982; Guthrie, 1977). The evaluation showed that Direct Instruction students were the highest ranked of the 9 major Follow Through models in the field of Reading Comprehension (Gersten, Carnine, & White, in press).

The controversy over the Follow Through evaluation and the ultimate effects of Direct Instruction on students (House et al., 1978) is muted somewhat by a recent longitudinal study of the Direct Instruction Follow Through students who had participated in the Direct Instruction programs during the primary grades (Gersten & Carnine, 1983). Our analyses looked at (a) percent who successfully graduate from high school, (b) percent who drop out, (c) college application and acceptance, (d) achievement scores in junior

high and high school, and (e) attendance. In most of the six communities included in the study, proportionally more Follow Through students graduated from high school and fewer dropped out. In several instances, a significantly higher proportion applied to college. In most communities, ninth grade reading scores were significantly higher. In E. St. Louis, New York, and Cherokee, the ninth grade reading scores were within a few percentie points of the national median (grade level).

These longitudinal findings provided added incentive for trying to understand the components of the Direct Instruction model, in particular how they might be effective in teaching comprehension to students in the intermediate grades. The theoretical perspective (Engelmann & Carnine, 1982), which has guided the research program on the components of Direct Instruction, is based on a limited set of assumptions about the learner--that the learner has the capacity to differentiate qualities and to note samenesses and differences among qualities. These simple assumptions were used to construct a taxonomy for classifying the skills and knowledge taught in school. The basis of the taxonomy is a set of structures, inherent in the skills and knowledge. Certain structures are associated with knowledge typically presented to young children--comparative properties, object attributes, etc. Other structures better describe what older students learn; e.g., cognitive routines like using a logic tree to troubleshoot failure in an electrical system. The structures in and of themselves are interesting, but their significance for educators stems from a unique instructional procedure tailored for use with each structure. These structures and the corresponding instructional procedures are too technical to be explained in this paper. However, there are several variables that characterize many of these

instructional procedures. An explication of these variables constitutes the next section of the paper.

Variables in the Direct Instruction Model

Table 1 lists the variables that characterize the Direct Instruction analysis for teaching comprehension. To many, the first set of variables in Table 1 is considered to provide a complete characterization of Direct Instruction. They derive from Rosenshine's (1976) synthesis of teacher effectiveness research. Rosenshine reported that reading achievemert tended to be higher when the students spent more time actively engaged in academic material, covering substantial amounts of text with a high rate of success. To do so, teachers elicit frequent student responses and provide immediate feedback, correcting errors by providing the right answer, or reviewing with the child the process for coming up with the answer. Rosenshine labeled this cluster of variables direct instruction. In this line of research, other phrases like academic learning time, curriculum alignment, and active teaching are also prominent.

Without question, Rosenshine's conception of direct instruction is the most prevalent. However, Rosenshine was not the only--or the first--person to use the phrase. The Direct Instruction Follow Through Project came into being in 1967. This project trained teachers and paraprofessionals to teach reading and mathematics to economically disadvantaged students. Training focused on many of the variables identified by Rosenshine. But the conception of direct instruction went beyond merely training teachers in specific techniques. The model also dealt with other domains that affect reading comprehension--the

Table 1

VARIABLES THAT DEFINE DIRECT INSTRUCTION

A. TEACHING TECHNIQUES (CORRECTION PROCEDURES, PACING) (GERSTEN, CARNINE, & WILLIAMS, 1982; GERSTEN, CARNINE, ZOREF, & CRONIN, 1981; BECKER, ENGELMANN & CARNINE, 1981)

B. OVERT STRATEGY, PROCESS CORRECTIONS, EXTENSIVE PRACTICE, AND FEEDBACK
   1. CRITICAL READING (PATCHING, KAMEENUI, CARNINE, GERSTEN, & COLVIN, IN PRESS)
   2. RULE-BASED DEDUCTIONS (CARNINE, KAMEENUI, & WOOLFSON, IN PRESS; CARNINE, KAMEENUI, & MAGGS, 1982; ROSS & CARNINE, 1982)
   3. SCHEMA AND GENERATIVE LEARNING (CARNINE, KINDER, SALVINO & MOORE, 1983)
   4. PRESENTING AND PROVIDING PRACTICE ON EXPOSITORY CONTENT (DARCH & CARNINE, 1983)
   5. STUDY SKILLS FOR CONTENT AREA MATERIAL (CARNINE, KAMEENUI, & MAGGS, 1982)
   6. LEGAL REASONING (FIELDING, KAMEENUI, & GERSTEN, IN PRESS)
   7. ANALYSIS OF ORAL READING ERRORS (CARNINE, CARNINE, & GERSTEN, IN PRESS)

C. BROAD APPLICATION
   1. META-COGNITIVE STRATEGIES, EG. SCHEMA (CARNINE, KINDER, SALVINO & MOORE, 1983)
   2. SPECIFIC SKILLS, EG. LEARNING VOCABULARY FROM CONTEXT (CARNINE, KAMEENUI, & COYLE, IN PRESS)
   3. TEXT STRUCTURE, EG. VISUAL DISPLAYS (DARCH & CARNINE, 1983)

D. DISCRIMINATION TRAINING
   EG. RULE-BASED DEDUCTIONS (CARNINE, KAMEENUI, & WOOLFSON, 1982)

E. PRESKILLS
   EG. SYNTAX--CLAUSE, PASSIVE VOICE, PRONOUN CONSTRUCTIONS (KAMEENUI, CARNINE & MAGGS, 1980; KAMEENUI & CARNINE, 1982; DOMMES, GERSTEN, & CARNINE, 1982)

F. EXTENSIVE PRACTICE AND FEEDBACK ONLY--NO STRATEGY
   1. CHARACTER MOTIVES (CARNINE, STEVENS, CLEMENTS, & KAMEENUI, 1982)
   2. LEARNING VOCABULARY FROM CONTEXT (CARMINE, KAMEENUI, & COYLE, IN PRESS)

G. AMOUNT OF PRACTICE
   EG. STORY PROBLEMS (DARCH, CARNINE, & GERSTEN, 1983)

strategies teachers modeled for students and the way the texts students read were composed.

Teacher Performance Variables

The earliest Direct Instruction studies looked at teacher behaviors, used with primary grade students. In these studies, the reading text and the strategies and skills taught were held constant. Techniques like the rate at which the teacher asked questions (Carnine, 1976), use of specified correction procedures (Carnine, 1980; Carnine, 1981), were found to affect students' levels of correct responding. Correction procedures, in particular, are pivotal in Direct Instruction. When students make errors, the teacher is not only expected to react, but also to do so in an appropriate fashion. For example, in many classrooms when teachers correct, they frequently respond to an error by calling on another student to answer or respond to a written mistake by making a check or writing "fix this." In our view, these types of "corrections" are inappropriate. If a student draws an incorrect inference, a trained Direct Instruction teacher would not merely give him the correct answer, but rather use a strategy correction, guiding the student through the steps that lead to the inference. (An illustration of a strategy correction appears later in the paper.)

Although the studies on individual teaching techniques showed fairly consistent relationships between the techniques, and performance measures of early reading acquisition, the studies suffered from several limitations: they involved relatively few students, all six and seven year olds, highly trained teachers, brief interventions, and a restricted range of measures. In response to these shortcomings, several longer term studies relating teacher

behavior and student learning were conducted, with naive teachers, more and older students, and a broader range of measures. In an in-depth natural study of seven teachers who were just learning the Model, observed levels of three variables--pacing, correction procedures, and student success rate--demonstrated a consistent, moderate to high relationship to gains in reading, as measured by standardized reading achievement tests (Gersten, Carnine, & Williams, 1982). The same pattern of relationships was replicated in the next year in the same district using a larger sample and a broader band of implementation measures (Gersten, Carnine, Zoref, & Cronin, 1983).

Gersten, et al. (1983) also looked more closely at how naive teachers acquire their teaching techniques. They found a wide variance in the degree to which new teachers came to implement the techniques. Some techniques were relatively easy for most teachers to master and were acquired relatively quickly (e.g., following the scripted lesson plans). (See Figure 1.) Others, such as use of correction procedures, appeared to be more complex and took longer to acquire. (See Figure 2.) For example, it took some of the new teachers and teaching aides at least two years to correct (rather than ignore) the majority of the errors students make during group instruction (Gersten, Carnine, & Williams, 1982).

Insert Figures 1 & 2 about here

The findings about teaching techniques should not be interpreted to mean that teachers need concern themselves only with the way they correct their students or their pacing of questions. Such misinterpretations stem from a

shortcoming, alluded to in the introduction, inherent in segmenting research into separate strands. The constant in the Gersten et al. studies (1981, 1982) was the first two levels of Direct Instruction reading curriculum. The effects of the teaching techniques might depend to a significant extent on the composition of the curriculum, more specifically the instructional design variables that define the instructional material. The rest of this section discusses those instructional design variables.

FIGURE 1

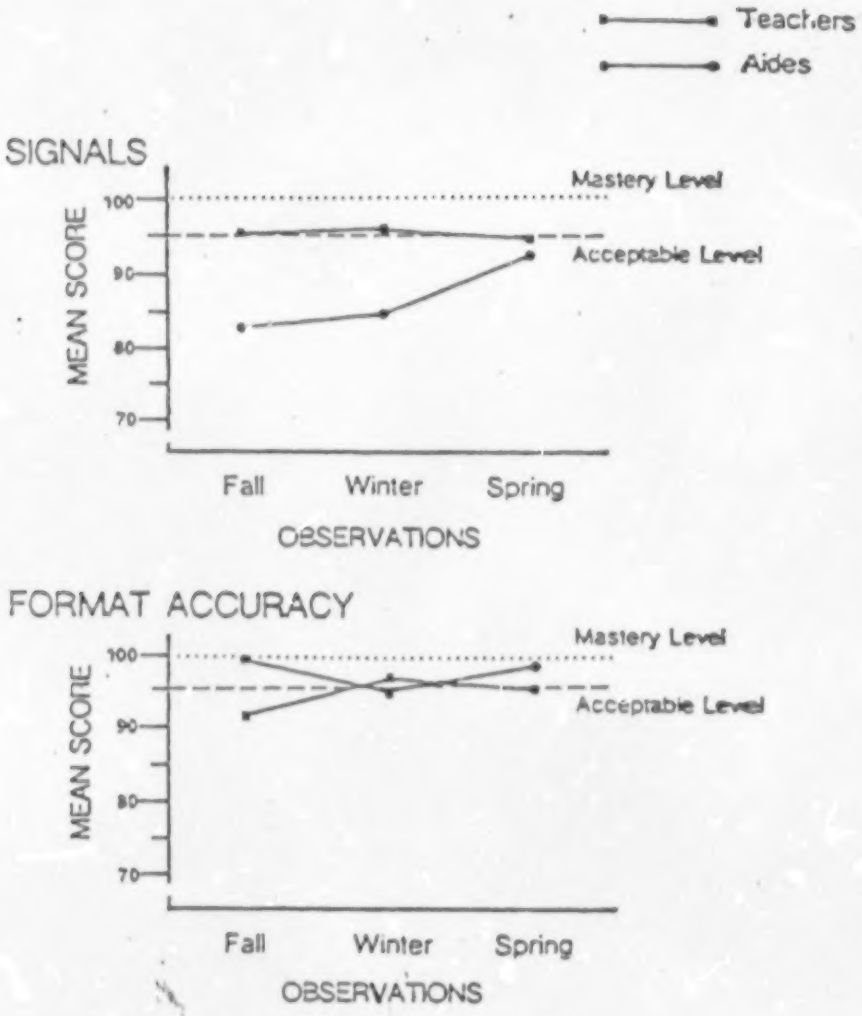
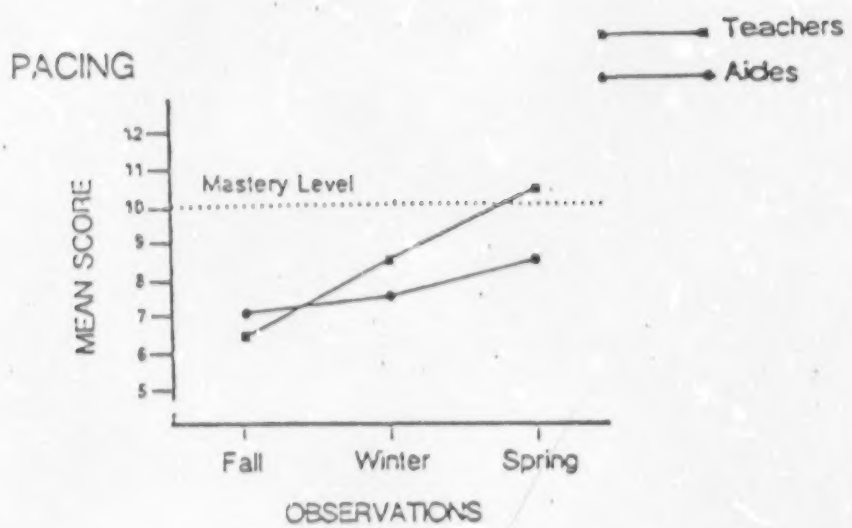
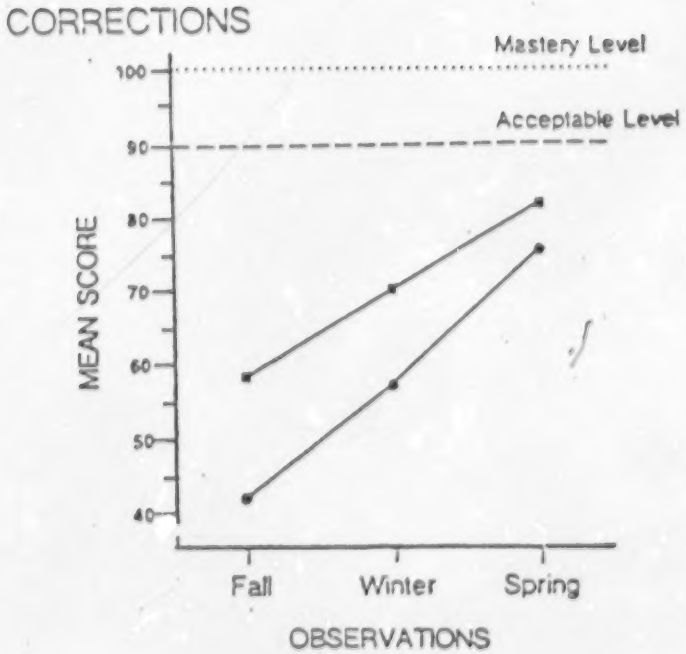

Teachers
Aides
SIGNALS
Mastery Level
Acceptable Level
MEAN SCORE
100
90
80
70
Fall
Winter
Spring
OBSERVATIONS
FORMAT ACCURACY
Mastery Level
Acceptable Level
MEAN SCORE
100
90
80
70
Fall
Winter
Spring
OBSERVATIONS

FIGURE 2


PACING
Teachers
Aides
MEAN SCORE
12
11
10
9
8
7
6
5
Mastery Level
Fall
Winter
Spring
OBSERVATIONS


CORRECTIONS
Mastery Level
Acceptable Level
MEAN SCORE
100
90
80
70
60
50
40
Fall
Winter
Spring
OBSERVATIONS

Instructional Design Variables

Overt Strategy. Perhaps the central principle in Engelmann and Carnine's (1982) analysis is the procedure for constructing overt strategies (entry b in Table 1). The purpose of devising an overt strategy is to make public to the students the thinking process that leads to solutions for a particular type of problem. The teacher demonstrates and then guides the students in applying a strategy comprised of several steps. This overt demonstration and guidance is most important for complex problems and tasks, particularly for students who do not intuitively devise ways of carrying out their assigned tasks. These students initially copy the steps modeled by the teacher, and later modify or personalize them. Two studies illustrate this strategy of teaching.

Fielding, Kameenui, and Gersten (in press) taught secondary students a strategy for evaluating legal cases. Direct Instruction students were explicitly taught the meaning of essential legal concepts such as fact, issue, decision, and rule or principle and how to use these concepts to relate new cases with cases studied earlier. When reviewing a new case, the students identified the facts, then the issue, the decision, and finally the reasons. This process was elaborated in several ways; e.g., rules used in decisions were explained, like requirements for evidence; rules based on previously reviewed cases were applied to new cases, etc. Direct Instruction students scored higher than inquiry students on both multiple choice and an essay test. The effects were maintained over a two-week period.

In a more conventional Direct Instruction strategy, students learned to extract and remember information from content area texts (Adams, Carnine, & Gersten, 1982). The six-step procedure is described in some detail in Table 2; the major steps in the strategy were: (1) Preview the passage by reading all the headings and subheadings; (2) Recite the subheading; (3) Ask yourself questions about what might be important to learn; (4) Read to find the

Table 2

Procedure for Studying Content Area Material

1. Preview the passage by reading all the headings and subheadings.
2. Recite the subheading.
3. Ask yourself questions about what might be important to learn.
4. Read to find the important details.
5. Reread the subheading. Recite important details.
6. Rehearse (read each subheading, recite important details).

important details; (5) Reread the subheading. Recite important details; (6) Rehearse (read each subheading, recite important details). Instruction on the overt strategy produced significantly higher comprehension test scores. However, students didn't tend to apply the six steps as they were modeled by the teacher. Many students deleted step 3, not asking themselves questions about what they might read about following a subheading.

Eventually, any strategy taught as an overt process must be internalized (and possibly altered) by the student, so that the student can apply it independently. But initially, overtization can be quite helpful to students as a model, and to teachers as a means of monitoring student learning and structuring feedback to the students.

Insert Table 2 about here

Correction Procedures. Perhaps the major advantage of teaching an overt strategy, in addition to serving as a model of the steps students can follow, is that the students' responses give the teacher the opportunity to provide corrective feedback on each step. For example, in the fifth step of the study skills strategy in Table 2, students are asked to recite important information under each subhead. If students omit pieces of key information, the teacher is alerted to the need to ask the students to go back over the first four steps and carefully monitor as they ask themselves questions about what they read. In short, an overt strategy makes it clearer to the student what is to be learned and clearer to the teacher what is to be taught.

General Case. Less apparent, but possibly more important is the way in which the content of an overt strategy is constructed to make it useful

in the widest possible range of settings while maintaining clear, concise explanations. The wide range of application is accomplished by assembling diverse examples and seeking out a "general case" strategy that can process as many of the examples as possible (entry c in Table 1). In a study on teaching critical reading, Patching, Kameenui, Carnine, Gersten, and Colvin (in press), first assembled various examples of propaganda devices, bias, literary critique, etc. They then analyzed the examples to identify strategies that could be used with the greatest range of examples. A strategy could not be devised that applied to all the examples; however, a strategy was devised that applied across different types of faulty arguments. (See Table 3 for three examples.) For each type, students were taught a rule. For "false causality," the rule was "Just because two things happen together, it doesn't mean that one causes the other." The teacher next showed students how to apply the rule. "Mary wins every race she runs in. She wears her lucky ring during every race. As long as she wears her lucky ring, she can't lose." Procedures for teaching the rule-based strategy, as it applies to faulty causality arguments, appears in Table 4. Briefly, the teacher had the students identify the two things that happened together in the example (winning a race, and wearing her lucky ring). Next, the students determined what two things happened together and they concluded, based on the rule, that the lucky ring did not cause her to win the race.

Insert Tables 3 and 4 about here

Discrimination practice. Instruction did not stop after the introduction of isolated rules about each of the three types of faulty arguments. Students also learned to discriminate among examples, deciding which rule, if any, applied. Providing discrimination practice is an important aspect of Direct

Instruction (entry d in Table 1). In one study students were taught to discriminate relevant from irrelevant, and distracting information, and then convert the relevant information into a more usable form. Table 5 presents a sample passage and teaching script from that study (Carnine, Kameenui, & Woolfson, 1982). The question at the end of the passage asks the reader which carrots John should buy. In the first paragraph John states his criterion for buying food--having lots of vitamins. Given this preference, the reader is expected to apply this rule from the second paragraph: "The fresher the food, the more vitamins it has." However, the passage contains several pieces of distracting information which makes the inappropriate choice appear attractive. The big, sweet, tasty, and inexpensive carrots from California sound inviting, but they're not as fresh as the smaller, local carrots. Relevant information is stated in an "indirect" form in the passage (yesterday versus a week and a half), which requires students to convert yesterday to one day old and a week and a half to ten days old before they can make the inference that the local carrots are fresher. Since fresher carrots have more vitamins, the correct answer is the local carrots. If students do not carefully discriminate the distracting and relevant information they're more likely to respond incorrectly.

Insert Table 5 about here

Teaching Component Skills. Students' performance on discrimination exercises depends to a great extent on the comprehensibility of the strategy students learn to apply. In the example in the preceding paragraph, the strategy is made more comprehensible by explicitly teaching students the component skill of how to convert information to a common metric, which allows direct comparisons. By learning to convert yesterday to "one day old" and a week and a half ago to "about ten days old," students can more

TABLE 4 (CONT'D)

Teacher: Do you know that Mary won the race because she wore her lucky ring?

Child: No.

c. Teacher: Why not?

Child: Just because two things happen together, it doesn't always mean that one causes the other.

d. Teacher: Yes, just because two things happen together, it doesn't always mean that one causes the other.

TABLE 3

CATEGORY, RULE AND EXAMPLE FOR THREE INVALID ARGUMENTS IN CRITICAL READING STUDY

1. CATEGORY 1: THE ABILITY TO DETECT FAULTY GENERALIZATIONS.

   RULE 1: JUST BECAUSE YOU KNOW ABOUT THE PART, IT DOESN'T MEAN YOU KNOW ABOUT THE WHOLE THING.

   EXAMPLE: SUE HAS LONG LEGS. SHE MUST BE A VERY GOOD RUNNER.

2. CATEGORY 2: THE ABILITY TO DETECT FALSE CAUSALITY.

   RULE 2: JUST BECAUSE TWO THINGS HAPPEN TOGETHER, IT DOESN'T ALWAYS MEAN THAT ONE CAUSES THE OTHER.

   EXAMPLE: JOHN'S MOTHER TOLD HIM NOT TO OPEN THE WINDOWS IN THE HOUSE AT NIGHT. "IF YOU OPEN THAT WINDOW, SOMEONE WE KNOW WILL GET SICK." A WEEK LATER, JOHN OPENED THE WINDOW IN THE HOUSE AND THAT NIGHT HIS SISTER, SUSIE, BECAME VERY SICK. OPENING THE WINDOW MUST HAVE DONE IT.

3. CATEGORY 3: THE ABILITY TO DETECT INVALID TESTIMONIAL.

   RULE 3: JUST BECAUSE AN IMPORTANT PERSON IN ONE AREA SAYS SOMETHING IS GOOD OR BAD IN ANOTHER AREA, YOU CAN'T BE SURE IT'S TRUE.

   EXAMPLE: DR. SMITH IS A VERY GOOD DOCTOR AND EVERYONE LIKES HIM. HE TELLS PEOPLE WHY THEY ARE SICK AND HELPS THEM GET BETTER QUICKLY. WHEN I WANTED TO BUY A LAWNMOWER, DR. SMITH TOLD ME THAT I SHOULD.

TABLE 4

OVERT PROCESS AND PROCESS CORRECTION FOR FALSE CAUSALITY RULE IN CRITICAL READING STUDY

1. Rule is introduced

   Teacher: Listen. Here's another rule. Just because two things happen together, it doesn't always mean that one causes the other.

2. Components of the rule tested

   a. Teacher: When two things happen together, does that always mean that one causes the other?

      Child: No.

   b. Teacher: No, just because two things happen together, it doesn't always mean that one causes the other.

3. Components of the rule identified in an example

   a. Teacher: Listen. I'm going to tell you two things that happened together. "Mary wins every race she runs in. She wears her lucky ring during every race."

      Tell me one thing that happened.

      Child: Mary wins every race she runs in.

   b. Teacher: Tell me another thing that happened.

      Child: Mary wears a lucky ring during every race.

      Correction procedure: Have child read each sentence. After reading first sentence, ask, "Is that one thing that happened?" Read the second sentence. Then ask, "What's the other thing that happened?"

4. Drawing a conclusion about the relationship between the components

   a. Teacher: What do we know about these two things?

      Child: They happen together.

   b. Teacher: Yes, we know that Mary wins every race she runs in and she wears her lucky ring during every race. Listen. Here's another sentence. "Mary won the race today because she wore her lucky ring."

TABLE 5

TEXT-BASED INFERENCES REQUIRING DISCRIMINATION OF DISTRACTING, DISPERSED, AND INDIRECTLY STATED INFORMATION

JOHN IS RECOVERING FROM A BAD COLD. HIS DOCTOR TOLD HIM TO CHANGE HIS EATING HABITS AND EAT GOOD FOODS. JOHN WENT TO THE LOCAL HEALTH FOOD STORE AND TOLD THE CLERK ABOUT HIS PROBLEM. "I AM TIRED OF BEING SICK ALL THE TIME. ALL I CARE ABOUT IS EATING GOOD FOOD WITH LOTS OF VITAMINS."

"I HAD COLDS ALL THE TIME UNTIL I STARTED EATING FRESH FOODS," THE CLERK SAID. "FRESH FOOD TASTES SO MUCH BETTER THAN CANNED FOODS AND HAVE A LOT MORE VITAMINS. WE HAVE THE BEST VEGETABLES IN TOWN - THEY ARE ALL ORGANIC. LOOK AT THESE NICE CARROTS. DID YOU KNOW THAT CARROTS HAVE MORE VITAMIN A THAN ANY OTHER VEGETABLE, AS WELL AS BEING HIGH IN VITAMINS D, C, AND K? YOU KNOW, THE FRESHER THE FOOD, THE MORE VITAMINS IT HAS. THIS BATCH OF CARROTS JUST ARRIVED FROM THE LARGEST FARM IN CALIFORNIA. HAVE YOU EVER SEEN SUCH BIG CARROTS? THEY HAD A GREAT GROWING SEASON DOWN THERE SO THEY ARE ESPECIALLY SWEET AND TASTY. ALSO, THE PRICE IS REALLY LOW. THEY ARE ONLY 29¢ A POUND. THEY ARE A WEEK AND A HALF OLD AND A GREAT BUY. CARROTS CAN BE PREPARED IN DIFFERENT WAYS. YOU CAN EAT THEM RAW OR COOKED. IT WOULDN'T TAKE MANY OF THESE BIG ONES TO MAKE A NICE CARROT CAKE.

"THESE SMALLER ONES ARE NICE, TOO. BUT THEY ARE JUST FROM A LITTLE GARDEN AROUND THE CORNER. THEY WERE PICKED YESTERDAY. BECAUSE IT RAINED SO MUCH THIS SUMMER, THESE CARROTS ARE SMALL AND DON'T HAVE AS MUCH TASTE. BUT THEY WOULD MAKE GOOD CARROT JUICE. THEY COST 52¢ A POUND. LAST YEAR CARROTS FROM THE SAME GARDEN WERE 10¢ A POUND, BUT I GUESS EVERYTHING COSTS MORE TODAY."

WHICH CARROTS DO YOU THINK JOHN BOUGHT - THE BIG CARROTS OR THE SMALL CARROTS?

TABLE 5 (CONT'D)

1. Introduction

Experimenter: "Read this story carefully, because you're going to answer the question at the end." The subject read the entire story at the end of the story orally.

2. Statement of Topic

Experimenter: "Now let's go back to the beginning of the story so we can figure out the answer to the question at the end of the story. "What does John want?"

Subject: "Not to be sick all the time."

3. Statement of Problem

Experimenter: "Right. What's most important to him?"

Subject: "To eat good food with lots of vitamins."

4. Discrimination Questions

Experimenter: "Is getting big carrots most important to him?"

Subject: "No."

Experimenter: "Is getting sweet and tasty carrots most important to him?

Subject: "No."

Experimenter: "Is getting cheap carrots most important to him?"

Subject: "No."

5. Review of Problem Statement

Experimenter: "What's most important to John?"

Subject: "To get food with lots of vitamins."

6. Identification of Rule

Experimenter: "What does it tell you in the story about getting lots of vitamins?"

Table 5 (cont'd)

Subject: "The fresher the food, the more vitamins it has."

7. Identification of Indirect Information

Experimenter: "Good. So what do you have to find out now to tell which carrots John will choose?"

Subject: "Which carrots are fresher."

8. Locating and Converting Indirect Information

Experimenter: "Find out how fresh the big carrots are."

Subject: "A week and a half old."

Experimenter: "Now find out how fresh the small carrots are."

Subject: "One day old."

9. Making the Text-Based Inference

Experimenter: "How fresh are the big carrots?"

Subject: "A week and a half old."

Experimenter: "How fresh are the small carrots?"

Subject: "One day old."

Experimenter: "What does that tell you about which carrots John will choose?"

Subject: "The small carrots."

10. Summary Strategy

Experimenter: "What is most important to John?"

Subject: "To eat good food with lots of vitamins."

Experimenter: "So, what carrots will John choose?"

Subject: "The small carrots."

Experimenter: "Why will John choose the small carrots."

Subject: "Because they have more vitamins."

Experimenter: "How do you know?"

Subject: "Because they're fresher."

Experimenter: "How fresh are the carrots?"

Subject: "The small carrots are one day old and the big carrots are a week and a half old."

easily decide which carrots are fresher. Note how learning is made easier when component skills are taught before a total strategy is introduced (Carnine, 1980).[1]

Limiting Cases for Strategy Practice and Feedback. Up to this point, the implicit assumption has been that modeling an explicit, overt strategy leads to higher performance. This is not always the case. Our research has shown that explicit modeling of a strategy is not always necessary; sometimes practice with workbooks is as effective. The studies listed under the Extensive Practice and Feedback Only--No Strategy heading in Table 1 are cases whereby merely providing extensive practice (and teacher feedback) on the skill was enough. For example, in a study of learning vocabulary from context (Carnine, Kameenui, & Coyle, in press) performance was as high for students who received extensive practice and corrective feedback from the teacher (the meaning of the missed word) as for students who also were presented a strategy. Yet, the strategy group required more teaching time. It may be that for relatively simple comprehension skills, such as using context clues to learn the meaning of unfamiliar vocabulary words, teachers do not need to model or explain an overt process. Students learn more efficiently by receiving extensive practice with feedback. (Remember, though, that in most studies, explicit instruction on a strategy contributed substantially to students' comprehension. In the critical reading study students in the practice with feedback group performed no better than control students who received no instruction related to critical reading.)

Even extensive practice and teacher feedback on purportedly critical comprehension skills do not necessarily insure improvements in comprehension, however. Researchers on pronoun constructions (e.g., Bormuth et al., 1970) have suggested that confusion about antecedents might impair students'

comprehension. Students taught to identify pronoun antecedents in expository passages using direct instruction presentation techniques scored significantly higher in identifying pronoun antecedents. Yet, these students did not correctly answer significantly more comprehension questions than students in a no-treatment control group (Dommes et al., 1982). The lack of effect for practice and feedback on the pronoun subskill highlights the importance of the relationship between an intervention and its intended effect. Note that systematic instruction improved students' ability to identify pronoun antecedents, but this ability did not seem to generalize to comprehension. Just as some strategies need not be explicitly modeled, possibly some skills do not require extensive teaching or practice. (It's important to note that the students in the Dommes et al. study had received instruction on pronouns in earlier grades. The conclusion being drawn does not imply that all instruction on pronouns is unnecessary.)

It may not be surprising to find cases where extra practice on a skill is not beneficial, but it <u>is</u> surprising to find a case when extra practice actually appears to impede learning. A study by Darch, Carnine, and Gersten (1983), examined the translation of word story problems into numerical equations. A 2X2 ANOVA design was used, with amount of practice and type of explanation (Direct Instruction overt strategy versus traditional activities taken from basal mathematics programs) serving as experimental variables (entry <u>g</u> on Table 1). For the two fixed amount of practice conditions, the number of practice examples (and time allocated to the unit) was determined by averaging the number of examples found in four state-adopted mathematics texts. The 60 problems were spread over an eleven lesson instructional sequence. In the Extended Practice condition, students were tested at

Table 6

Preskill Instruction for Passive Voice and Clause Constructions

Passive Voice Constructions.

1. Experimenter: Listen, I'll read a sentence and you follow along: Gronk was teased by Bubbles. I can say it another way. Listen: Bubbles teased Gronk.
2. Experimenter: I'll say the sentence again. Gronk was teased by Bubbles. Now you say the sentence the other way. Child: Bubbles teased Gronk. If the child made an error, the Experimenter stopped the child and modelled the response as in step 1. The Experimenter then tested the child on step 2. Steps 1 and 2 were repeated with three new sentences. (Steps 1 and 2 were faded when the child reached 50 percent level of correct performance on the questions.) After steps 1 and 2 had been completed with all four sentences, steps 3 to 5 were presented with all four sentences.
3. Experimenter: Now I'm going to say a sentence and ask you a question. Listen: Gronk was teased by Bubbles. Now say it the other way to yourself.
4. Experimenter: Who did the teasing? Child: Bubbles.
5. Experimenter: Who got teased? Child: Gronk.

Clause Constructions

1. Experimenter: I'll read the first sentence; you follow along. "Henry, who kissed Joan, ran home crying." (Experimenter points to *who*.) Listen, *who* stands for Henry. So I can say two sentences for this one: Henry kissed Joan. Henry ran home crying.
2. Your turn. You read the sentence. (The child reads the sentence aloud.) What does *who* stand for? Child: Henry.
3. Experimenter: So, tell me one sentence you can say. Child: Henry kissed Joan. (If error, Experimenter models step 1, then tests on step 2.)
4. Experimenter: Now, tell me the other sentence. Child: Henry ran home crying. (If the child made an error, the Experimenter repeated step 1 and also crossed out "who kissed Joan" so the construction would look like "Henry, ~~who kissed Joan~~, ran home crying." The Experimenter continued the correction by repeating steps 2-4.)
5. Experimenter: Now say two sentences for this one. Child: (reads construction) Henry kissed Joan. Henry ran home crying.

three points in the instructional sequence, and given up to eight remedial lessons if they scored less than 90% correct on any of the three tests.

The rather surprising finding was that students in the traditional training with extended practice treatment scored most poorly of the four groups. Extra practice and instruction designed to help students devise their own strategies seemed to frustrate the students, which may have acounted for their low scores. Conversely, the explicit strategy treatment with extended practice had significantly higher maintenance test scores. When extended practice was paired with clear, systematic instruction in how to analyze word problems, students maintained the skill. It seems that more practice, in and of itself, is not necessarily beneficial to students' learning. Amount of practice must be evaluated in terms of other variables, instruction on explicit strategies, preskill teaching, provision of discrimination examples, and the teaching techniques used by the teacher.

Studies that look at the interactions among these variables may reveal relationships similar to the one previously cited; i.e., with lower performing students and unclear strategies, extra practice may be counterproductive (Darch et al., 1983). These interactions are important because for some skills, strategy teaching is not needed (Carnine et al., 1982). Some "skills" may not even require teaching (Dommes et al., 1982). Obviously, a long list of interactions among variables could be suggested. The Direct Instruction research program outlined in Table 1 represents a first attempt to enumerate some of the important instructional variables and their interactions.

Domains Related to Comprehension

In the preceding section, a research program in comprehension instruction was analyzed according to major design variables. In this section, the Direct Instruction research program is analyzed in a different way, according

to goals of instruction--the skills and strategies students are to learn and the texts from which they are to learn. Table 7 lists these domains and the studies, taken from Table 1, which have been conducted within each domain.

Meta-cognitive Strategies. The first domain listed in Table 7 is meta-cognitive strategies. With meta-cognitive strategies (sometimes referred to as executive functions), students construct and monitor relationships among information from texts, their background knowledge and skills in their repertoire. While much has been written on meta-cognitive strategies, and some descriptive studies have been done, relatively few studies have tried to teach meta-cognitive strategies to students. For example, college students with reading problems who were taught study rules and procedures for monitoring their use of the rules made sustained gains in reading comprehension (Brown, Campione, & Day, 1981).

Insert Table 7 about here

The Direct Instruction study selected to illustrate the metacognitive domain (Carnine, Kinder, Salvina, & Moore, 1983) actually compared two meta-cognitive strategies--schema learning (Singer & Donlan, 1982) and generative learning (Linden & Wittrock, 1981). Prior research had focused primarily on narrative stories and used average or above average students. The Direct Instruction study looked at the performance of poor comprehenders on narrative as well as expository material, which has received little research attention with elementary students. The schema learning strategy for narrative material was based on story grammar. Students learned to answer four questions: "Who is the story about? What does s/he want to

do? What happens when s/he tries to do it? What happens in the end?" In the final step of the strategy, students summarized the story. For expository content, students in the schema group identified major rules, used the rules to explain examples given in the text and finally made up their own examples of applications of the rule. For example, with the rule "Gases and liquids move from a place of high pressure to places of low pressure," a student example might be this: "When you blow a horn, the high pressure is in your mouth, and the low pressure is outside the horn." Generative-learning strategy students formed an image after each unit of text, described the image, and at the end of the passage, summarized the entire passage. This strategy was applied to both narrative and expository material.

Both treatments produced substantial gains over pretest scores. However, only one difference between treatments was significant, which may have resulted from the Direct Instruction features common to both treatments (instruction on an overt process, extensive practice, immediate feedback, fading of structure) and instruction on a strategy that called for a summarization of each chunk of information in the selection in the story and finally of the entire story.

The significant difference between the two groups was on the expository maintenance test. The higher scores for the schema group might be explained by the more specific instruction they received--search out key rules, use them to explain examples in the text, and construct new examples. The chunking, imaging, and summarizing in the generative strategy may not have been as helpful for the scientific materials, since rules are more clear cut in

TABLE 7

DIRECT INSTRUCTION COMPREHENSION RESEARCH ON

DIMENSIONS OF COMPREHENSION

META-COGNITIVE STRATEGIES

1. SCHEMA AND GENERATIVE LEARNING (CARNINE, KINDER, SALVINO, & MOORE, 1983)
2. STUDY SKILLS FOR CONTENT AREA MATERIAL (ADAMS, CARNINE, & GERSTEN, 1982)
3. READING FOR MEANING (ORAL READING ERRORS) (CARNINE, CARNINE, & GERSTEN, IN PRESS)

SPECIFIC SKILLS

1. LEARNING VOCABULARY FROM CONTEXT (CARNINE, KAMEENUI, & COYLE, 1982)
2. CRITICAL READING (PATCHING, KAMEENUI, CARNINE, GERSTEN, & COLVIN, IN PRESS)
3. RULE-BASED DEDUCTIONS (CARNINE, KAMEENUI, & WOOLFSON, 1982; CARNINE, KAMEENUI, & MAGGS, 1982; ROSS & CARNINE, 1982)
4. CHARACTER MOTIVES (CARNINE, STEVENS, CLEMENTS, & KAMEENUI, 1982)
5. SYNTAX--PRONOUN CONSTRUCTIONS, CLAUSES, PASSIVE VOICE (KAMEENUI, CARNINE, MAGGS, 1980; KAMEENUI & CARNINE, 1982; DOMMES, GERSTEN, & CARNINE, 19
6. VOCABULARY DRILL (KAMEENUI, CARNINE, & FRESCHI, 1982)
7. MATHEMATICS WORD PROBLEM (DARCH, CARNINE, & GERSTEN, 1983)

TEXT STRUCTURE

1. PRESENTING AND PROVIDING PRACTICE ON EXPOSITORY CONTENT (DARCH & CARNINE, 1983)
2. LEARNING VOCABULARY FROM CONTEXT (CARNINE, KAMEENUI, & COYLE, 1982)
3. CRITICAL READING (PATCHING, KAMEENUI, CARNINE, GERSTEN, & COLVIN, IN PRESS)
4. RULE-BASED DEDUCTIONS (CARNINE, KAMEENUI, & WOOLFSON, 1982; CARNINE, KAMEENUI, & MAGGS, 1982; ROSS & CARNINE, 1982)
5. CHARACTER MOTIVES (CARNINE, STEVENS, CLEMENTS, & KAMEENUI, 1982)
6. SYNTAX--PRONOUN CONSTRUCTIONS, CLAUSES, PASSIVE VOICE (KAMEENUI, CARNINE, MAGGS, 1980; KAMEENUI & CARNINE, 1982; DOMMES, GERSTEN, & CARNINE, 1982)

science. The generative learning strategy might prove superior with social studies content, which more closely resembles the episodic nature of narrative passages that is so amenable to the generative strategy.

Specific Skills. Though possibly less interesting and intellectually exciting than meta-cognitive strategies, training in specific skills provides essential grist for the workings of meta-cognitive strategies. Imagine the frustration of trying to teach students to identify and apply key rules from expository passages when the students don't have the skills to draw inferences. Or consider Cohen and Stover's study (1981) on problem solving, which involved teaching several specific skills--disregarding extraneous information, transposing numbers appearing out of order in the passage, and constructing diagrams to show the relationships among the relevant numbers in the story.

The application of Direct Instruction to specific skill training is illustrated in a study having to do with vocabulary (Kameenui, Carnine, & Freschi, 1982). Students who received vocabulary training repeated the definition of a new word and then answered several questions which required an understanding of the word. These steps were repeated with the second word and then questions based on both words were asked. This pattern was repeated until the student could answer at least one question based on each of six vocabulary words. Students who received this training scored as well on inferential comprehension questions as students who read the passage with easy vocabulary substituted for the unfamiliar vocabulary (easy words appear above underlined words in Table 8).

Insert Table 8 about here

TABLE 8

PASSAGE WITH UNFAMILIAR VOCABULARY (UNDERLINED), EASY VOCABULARY (ABOVE DIFFICULT VOCABULARY), AND REDUNDANT INFORMATION (IN PARENTHESES)

JOE AND ANN WENT TO SCHOOL IN PORTLAND. THEY WERE ANTAGONISTS (ENEMIES). THEY SAW EACH OTHER OFTEN. THEY HAD LOTS OF ALTERCATIONS (FIGHTS). (THEY JUST DIDN'T GET ALONG VERY WELL.) AT THE END OF HIGH SCHOOL, ANN MALIGNED (ANN SAID BAD THINGS ABOUT JOE.) JOE. THEN ANN MOVED AWAY. JOE STAYED IN PORTLAND. HE GOT A JOB AS A BAILIFF (HE WORKED FOR A JUDGE.). ONE DAY JOE WAS WORKING, AND HE SAW ANN (TALKING TO A POLICEMAN AND ANSWERING QUESTIONS). ANN DID NOT SEE JOE. ANN LOOKED APPREHENSIVE (AFRAID). SHE WAS UNDER ARREST. SHE WAS BEING INCARCERATED.

Another specific skills study taught students to identify a character's true, as opposed to apparent motives (Carnine, Stevens, Clements, & Kameenui, 1982). A passage taken from the study appears in Table 9. During initial instruction, students in the rule-plus-practice group were told a rule ("There may be more than one reason why someone does or says something."), asked questions related to the apparent motives, asked questions about an alternative, less obvious motive, and assisted in comparing the two motives. this explicit questioning process was dispensed with on the final training day, and reinstituted only if students made mistakes. Students in this treatment and a practice with feedback treatment scored significantly higher on a transfer test than control students

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Insert Table 9 about here

Text Structure. The first two parts of Table 7 deal with meta-cognitive strategies and specific skills. As mentioned earlier, these studies also frequently involve specially designed text material. Some studies investigate text structure as a variable in its own right, since text structure can hinder as well as enhance comprehension, just as the presence or absence of important strategies and skills affects comprehension. For example, when the hierarchical structure of an expository passage is apparent, through the use of headings, etc., comprehension improves (Meyer et al., 1980).

The study that represents the most radical departure from traditional text structure does not use any written prose. Visual displays showing key concepts and their interrelationships were presented accompanied by teacher explanations (Darch & Carnine, 1983). A sample visual display appears in Figure 3. The organization of the display reflects the structural relationships among the concepts related to manufacturing. The

TABLE 9

IDENTIFYING CHARACTER MOTIVES

ALL RABBITS LOVE LETTUCE, ESPECIALLY CLOVER. HE AND THE OTHER RABBITS LIVED JUST OUTSIDE THE KING'S CASTLE, BUT THEY DIDN'T LIKE THE KING BECAUSE HE WOULDN'T LET THEM NEAR HIS GARDEN, EVEN THOUGH HE LET OTHER ANIMALS PLAY IN THE GARDEN.

THE KING HAD THE FINEST GARDEN IN ALL THE LAND, BUT HE KEPT IT WELL GUARDED FROM THE RABBITS. IF ANY RABBITS WERE CAUGHT IN HIS GARDEN, THEY WERE PUT IN A BOX AND SENT TO THE NORTH POLE AND CLOVER WAS VERY MAD AT THE KING.

ONE DAY CLOVER GOT AN IDEA. A RABBIT COULD NOT SNEAK INTO THE KING'S GARDEN, BUT A RABBIT COULD SNEAK INTO THE KING'S KITCHEN. CLOVER SNEAKED INTO THE KING'S KITCHEN EVERY MORNING FOR SEVERAL DAYS. EACH DAY THE KING'S MEN BROUGHT IN SOME LETTUCE FOR DINNER, AND EACH DAY CLOVER POISONED THE LETTUCE. SOON THE KING AND EVERYONE IN HIS PALACE WAS SICK.

THE KING WAS VERY SAD WHEN HE LEARNED THAT HIS LETTUCE WAS MAKING EVERYONE SICK. HE ORDERED HIS SOLDIERS TO DIG UP THE LETTUCE FROM HIS GARDEN. THEN HE ORDERED THE LETTUCE DUMPED OUTSIDE THE CASTLE, NEAR WHERE THE RABBITS LIVED.

THE KING WAS VERY PLEASED WITH HIMSELF. HE WOULD SOLVE TWO PROBLEMS AT ONCE.

TABLE 9 (CONT'D)

RULE PLUS PRACTICE TREATMENT

1. Experimenter presents rule:

   Listen, here's a rule. There may be more than one reason why someone does or says something. I'll repeat that one more time.

2. Subject reads story:

   a. Experimenter: You're going to read a short story out loud to me. When you're done reading, I'm going to ask you some questions. OK?

   b. Subject reads a story with the experimenter correcting decoding errors using a whole word correcting procedure (e.g., "That word is _____.").

3. Experimenter presents rule again:

   Before I ask you the questions, I want to tell you the rule again. There may be more than one reason why someone does or says something.

4. Experimenter asks questions about apparent motive.

   a. Why was Clover in the King's kitchen?
   "To poison the lettuce."

   b. Why did Clover want to poison the lettuce?
   "To make the King sick."

   c. Why did Clover want to make the King sick?

   "He was mad at the King;" or
   "To get back at the King."

5. Experimenter asks questions that suggest a different motive.

   a. Did the poisoned lettuce make the King sick? "Yes."

   b. What did the King do with the lettuce?

   "The King's men dumped it near where the rabbits lived."

   c. Is that something Clover may have wanted?
   "Yes."

   d. Why would Clover want that.

   "To get the lettuce for the rabbits."

   e. So, why did Clover really poison the lettuce?

   "To get the lettuce," or
   "To make the King dump the lettuce so that rabbits could eat it."

Table 9 (cont'd)

6. Experimenter asks questions that provide a summary of inferential process for determining the character's motive.

   a. What did Clover want:

      "The lettuce. Rabbits love lettuce. The King had the best lettuce," or

      "Clover poisoned kitchen lettuce, not the garden lettuce that the King threw out."

   b. What did Clover do to get what he wanted?

      "Poisoned the lettuce."

   c. Why did Clover poison the lettuce?

      "So the King would dump it, and the rabbits could eat it"; or "To get the lettuce."

requisites for manufacturing appear at the top of the visual display--transportation, power, labor, and markets. Next a symbolic path showing the progression from raw materials to factory to finished product is illustrated. Under the symbolic path appear specific instances, e.g., iron goes to a factory and comes out steel. The teacher explains and highlights these relationships (see Table 1). Visual displays, when accompanied by group practice, produced higher post test scores than three other treatments. However, since the visual displays, when used in one treatment with a different practice procedure, did not yield higher scores, the effectiveness of visual displays cannot be ascertained without additional research.

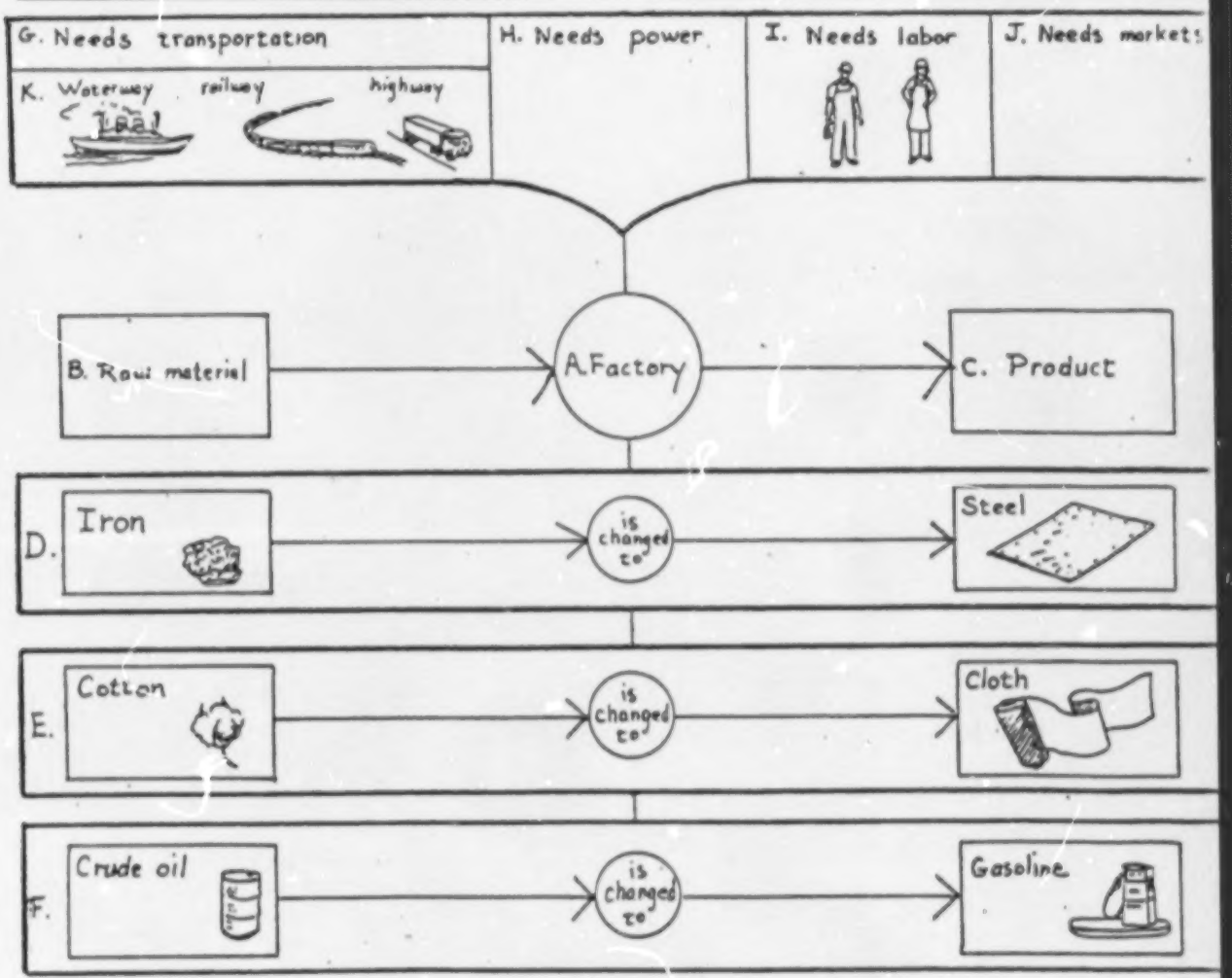
Insert Figure 3 and Table 10 about here

Discussion

A common theoretical perspective can bridge research across the dimensions that influence comprehension. A major contribution of such a research program is that it highlights the interrelatedness of the dimensions. Improving our understanding and instructional practices in comprehension will not come through a narrow vision of the instructional process. Meta-cognitive strategies--in isolation, skill training--in isolation, teaching techniques--in isolation, text structure--in isolation--these isolated components evoke the image of the four blind men, each feeling a different part of an elephant. Their descriptions were quite different, yet accurate, but incomplete.

FIGURE 3

VISUAL DISPLAY FOR TEACHING ABOUT MANUFACTURING



CONTINUED

TABLE 10

Teacher Does	Teacher Says and Does	Students Says
1. Present Figure 3.6 Touch A.	This chart shows what a factory does. **Factory.** Say it. *(Signal.)* A factory takes *(touch B)* raw material and changes it into *(touch C)* a product. Remember: *(follow arrow from B to A.)* **Raw material goes into a factory.** *(Follow arrow from A to C.)* **A product comes out of the factory.**	"Factory."
2. Touch B. Touch iron, cotton, crude oil.	First I'll tell you about some raw materials. **Raw material.** Say it. *(Signal.)* Remember: Raw material goes into a factory.	"Raw material."
3. Touch iron.	**Iron.** Say it. *(Signal.)* Iron is a raw material. Iron comes from iron mines.	"Iron."
4. Touch cotton.	**Cotton.** Say it. *(Signal.)* Cotton is a raw material. It grows on plants.	"Cotton."
5. Touch crude oil.	**Crude oil.** Say it. *(Signal.)* Crude oil is a raw material. It comes **from under the ground.**	"Crude oil."
6. Touch steel, cloth, gasoline.	A factory takes a raw material and changes it into a product. **Product.** Say it. *(Signal.)* These are products. Remember: A product comes out of a factory.	"Product."
7. Touch D.	*(Follow arrow and touch each space as you say)* **Iron is changed to steel.** Say it. *(Signal.) (Follow arrow and touch each space as children respond.)* Steel is used to make many things — cars, lawnmowers, cans, and hundreds of other products. Remember: **Iron is changed to steel.**	"Iron is changed to steel."
8. Touch E.	*(Follow arrow and touch each space as you say)* **Cotton is changed to cloth.** Say it. *(Signal.) (Touch each space as children respond.)* Some factories take the raw material cotton and change it into cotton cloth. Some shirts and blue jeans and sheets are made of cotton cloth. Remember: **cotton is changed to cloth.**	"Cotton is changed to cloth."
9. Touch F.	*(Follow arrow and touch each space as you say)* **Crude oil is changed to gasoline.** Say it. *(Signal.) (Touch each space as children respond.)* Some factories take crude oil and boil it and put things in it. When they are done, they have changed the crude oil to gasoline. Crude oil also makes plastic and oil. But the big product is gasoline. Remember: **crude oil is changed to gasoline.**	"Crude oil is changed to gasoline."
10. Touch A. Touch G. Touch H. Touch I. Touch J.	A factory needs things if it is to change raw material into products. Here are the things it needs. A factory **needs transportation.** It **needs power.** It **needs labor,** and It **needs markets.**	
11. Touch G.	A factory needs transportation. **Needs transportation.** Say it. *(Signal.)* Transportation is what we do when we move something from one place to another. We need transportation to bring the raw material to the factory. We need transportation to move the product from the factory to some place where we can see it.	"Needs transportation."
Touch K.	Here are the big types of transportation used by factories: waterway, railway, highway. **Waterway, railway, highway.** Say it. *(Signal.)* *(Touch boat.)* A waterway is what boats use. A waterway is a river or a lake or an ocean. *(Touch train.)* A railway is what trains use. *(Touch truck.)* A highway is what trucks use. Remember: waterway for boats, railway for trains, highway for trucks.	"Waterway, railway, highway."
12. Touch H.	A factory needs power. **Needs power.** Say it. *(Signal.)* Some factories use steam power. They heat water with coal until the water turns into steam. Then the steam runs the machinery in the factory. Some factories use electric power. The electricity runs the machinery. Remember: *(touch A)* a factory *(touch G)* needs transportation and *(touch H)* needs power.	"Needs power."
13. Touch I.	A factory needs labor. **Needs labor.** Say it. *(Signal.)*	"Needs labor."

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TABLE 10 (CONT'D)

Teacher Does	Teacher Says and Does	Students Says
	Labor is another name for the workers who operate the machines in a factory. A lot of work is done by the machines, but some products need a lot of labor. Remember: *(touch A)* a factory *(touch G)* needs transportation and *(touch H)* needs power *(touch I)* and needs labor.	
14. Touch J.	The last thing a factory needs is a market. Needs market. Say it. *(Signal.)* A market is a place where the product is sold. The big markets are the big cities. The big cities are big markets because there are a lot of people in the big cities. Remember: needs markets.	"Needs market."
15. Touch G.	Let's go over the needs of a factory one more time. Say it. *(Signal.)*	"Needs transportation."
Touch K.	What kinds of transportation are there? *(Signal.)*	"Waterway, railway, highway."
Touch H.	Say it. *(Signal.)*	"Needs power."
Touch I.	Say it. *(Signal.)*	"Needs labor."
Touch J.	Say it. *(Signal.)*	"Needs markets."
16.	Get ready to tell me all the facts about a factory.	
17. Touch the spaces in this order: (A,B, C,D,E,F,G-K, H,I,J.)	*(For each space, say)* Say it. *(Signal.)* *(Repeat until firm.)*	*(Children respond.)*
18. Remove Figure 3.6.		
19. Present Figure 3.7	The spaces are empty on this chart. Get ready to tell me the exact words that go in each space.	
20. Touch the spaces in this order: A,B,C, D,E,F,G-K,H, I,J.)	*(For each space, say)* Say it. *(Signal.)*	*(Children respond.)*

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This is not to say that the Direct Instruction perspective is the only possible position for building an integrated research program. The point is that integrated intra-dimension programs are possible, even fruitful. The current program needs expansion, though. Most noticeably missing is aptitude treatment interaction research. The statements about the differential importance of strategy teaching and practice with feedback on simpler and more complex tasks might be tempered by studies that included both higher and lower performing students.

The findings reported in this paper suggest that Direct Instruction provides a viable framework for analyzing comprehension instruction, in terms of teaching techniques, text structures, meta-cognitive strategies, and specific skills. The variables in Table 1 that characterize the Direct Instruction analysis provide guidelines for devising comprehension instruction and research. Many of these variables, like preskill teaching, and extensive practice with feedback, have received attention for a number of years. Other variables are less prominent, yet quite important--instruction on an overt strategy, devising strategies that teach the general case and even appropriate discrimination practice.

It's also interesting to note some findings not typically reported. Some meta-cognitive strategies develop over relatively long periods of time, in contrast to strategies presented in an intervention of just a few days duration. For example, the somewhat different type of meta-cognitive strategy, suggested by Goodman's miscue analysis of oral reading errors (Allen, 1976), measures the integration of contextual and graphic cues during oral reading. (Decoding can be considered a meta-cognitive strategy because it involves the concurrent processing of graphic, syntactic, and semantic cues and self-

monitoring of responses made based on those cues.) A concern about initial Direct Instruction in decoding (synthetic phonics) is that students will not fully develop the contextual aspect of this meta-cognitive strategy. Carnine, Carnine, and Gersten (in press) reported that first graders who received synthetic phonics instruction made errors with low levels of contextual constraint. However, at the end of four years of instruction, phonics-taught third graders from four communities--urban Black, rural white, American-Indian and Hispanic-made errors which were both graphically and contextually constrained. Facility in the complex meta-cognitive decoding strategy appeared to take several years to develop.

Another interesting implication of the miscue (Carnine et al., in press) and generative/schema studies (Carnine, et al., 1983) is that students do not always need to be explicitly taught a self-monitoring procedure as Brown et al. (1981) may lead one to believe. When students in the schema treatment were tested, they were not told to use story grammar questions for the narrative story and to use the rule extraction and application procedure for the expository passage. The students had to decide for themselves how to approach each selection. Reasonably high maintenance tset scores on both narrative stories and expository passages suggests that extensive practice with feedback seemed sufficient for students to know when to use the appropriate strategy. This implication is consistent with the earlier-cited finding that prompting and modeling is not an essential ingredient in Direct Instruction procedures for teaching comprehension. Sometimes extensive practice with feedback will suffice for both specific skills and meta-cognitive strategies.

References

Adams, A., Carnine, D., & Gersten, R. Instructional strategies for studying content area texts in the intermediate grades. Reading Research Quarterly, in press.

Allen, P. D. (Ed.) Findings of research in miscue analysis: Classroom implications. National Council of Teachers of English, 1976.

Beck, I. L., Omanson, R. C., & McKeown, M. G. An instructional redesign of reading lessons: Effects on comprehension. Reading Research Quarterly, 1982, 17, 462-481.

Bormuth, J.R., Manning, J.C., Carr, J.W., & Pearson, P.D. Children's comprehension of between- and within-sentences syntactic structures. Journal of Education Psychology, 1970, 61, 349-357.

Brown, A. L., Campione, J. C., & Day, J. D. Learning to learn: On training students to learn from texts. Educational Researcher, 1981, 2, 14-21.

Carnine, D.W. Effects of two teacher presentation rates on off-task behavior, answering correctly, and participation. Journal of Applied Behavioral Analysis, 1976, 9, 199-206.

Carnine, D.W. Phonic versus whole-word correction procedures following phonic instruction. Education and Treatment of Children, 1980, 3 323-330.

Carnine, D.W. Preteaching versus concurrent teaching of the component skills of a multiplication algorithm. Journal of Research in Mathematics Education, 1980, 11(5), 375-378.

Carnine, D.W. High and low implementation of direct instruction teaching techniques. Education and Treatment of Children, 4(1), 1981, 42-51.

Carnine, L., Carnine, D., & Gersten, R. Analysis of oral reading errors made by economically disadvantaged students with a synthetic-phonics approach. Reading Research Quarterly, in press.

Carnine, D., Kameenui, E., & Coyle, G. Utilization of contextual information in determining the meaning of unfamiliar words. Reading Research Quarterly, in press.

BEST COPY AVAILABLE

Carnine, D. W., Kameenui, E. J., & Maggs, A. Components of analytic assistance: Statement saying, concept training, and strategy training. Journal of Educational Research, 1982, 75, 374-377.

Carnine, D. W., Kameenui, E. J., & Woolfson, N. Training of textual dimensions related to text-based inferences, Journal of Reading Behavior, 1982, 14, 335-340.

Carnine, D., Kinder, D., Salvino, T., & Moore, A. Generative and schema instruction on narrative and expository prose for skill deficient intermediate grade students. Unpublished manuscript. University of Oregon, Eugene, OR, 1983.

Carnine, D. W., Stevens, C., Clements, J., & Kameenui, E. Effects of facilitative questions and practice on intermediate grade students' understanding of character motives. Journal of Reading Behavior, 1982, 14(2), 179-190.

Cohen, S. A., & Stover, G. Effects of teaching sixth grade students to modify format variables of math word problems. Reading Research Quarterly, 1981, 16, 175-200.

Darch, C. & Carnine, D. Strategies for presenting and providing practice on expository content. Unpublished manuscript, University of Oregon, Eugene, OR, in preparation.

Darch, C., Carnine, D., & Gersten, R. Instructional strategies and levels of practice for mathematics problem solving in fourth graders. Paper presented at AERA; Montreal, PQ; April, 1983.

Dommes, P., Gersten, R., & Carnine, D. W. Instructional procedures for increasing skill deficient fourth graders' comprehension of syntactic structures. Unpublished manuscript. University of Oregon Follow Through Project, Eugene, OR 1982.

Engelmann, S. & Carnine, D. W. Theory of instruction. New York: Irvington, 1982.

Kameenui, E., Carnine, D., & Freschi, R. Effects of text construction and instructional procedures for teaching word meanings on comprehension of contrived passages. Reading Research Quarterly, 1982, 17(3), 367-388.

Kameenui, E., Carnine, D., & Maggs, A. Instructional procedures for teaching reversible passive voice and clause construction to three mildly handicapped children. Exceptional Child, 1980, 27, 29-40.

Linden, M. & Wittrock, M. C. The teaching of reading comprehension according to the model of generative learning. Reading Research Quarterly, 1981, 1, 44-57.

Meyer, B. J., Brandt, D. M., & Bluth, G. J. Use of top-level structure in text: Key for reading comprehension of ninth-grade students. Reading Research Quarterly, 1980, 16, 72-103.

Patching, W., Kameenui, E., Carnine, D., Gersten, R., & Colvin, G. Direct instruction in critical reading. Reading Research Quarterly, in press.

Pearson, P. D. A context for instructional research on reading comprehension. (Tech. Rep.) Urbana, IL: Center for the Study of Reading, in press.

Rosenshine, B. V., & Berliner, D. C. Academic engaged time. British Journal of Teacher Education, 1978, 4, 3-16.

Ross, D., & Carnine, D. W. Analytic assistance: Effects of example selection, subjects' age, and syntactic complexity. Journal of Educational Research, 1982, 75, 294-298.

Patching, W., Kameenui, E., Carnine, D., Gersten, R., & Colvin, G. Direct instruction in critical reading. Reading Research Quarterly, in press.

Pearson, P. D. A context for instructional research on reading comprehension. (Tech. Rep.) Urbana, IL: Center for the Study of Reading, in press.

Gall M. D. The importance of context variables in research on teaching skills. Research in Teacher Education, 1977, 28, 43-48.

Gersten, R. The site variability issue in Follow Through revisited: Some new data, some new methodologies, and new insights. Paper presented at a symposium at AERA, New York, NY; March 1982.

Gersten, R., & Carnine, D. The later effects of Direct Instruction Follow Through: Preliminary findings. Paper presented at AERA; Montreal, PQ; April 1983.

Gersten, R., Carnine, D. W., & White, W. A. Direct instruction and applied behavior analysis. In W. Heward et al. (Eds.), Behavior analysis in education. Columbus, OH: Charles Merrill, in press.

Gersten, R., Carnine, D., & Williams, P. Measuring implementation of a structured educational m odel in an urban school district: An observation approach. Education Evaluation and Policy Analysis, 1982, 4(1), 67-79.

Gersten, R., Carnine, D., Zoref, L., & Cronin, D. A multi-faceted study of implementation of educational change in an urban setting. Paper presented at AERA, Montreal, PQ; April 1983.

Guthrie, J. T. Follow Through: A compensatory education experiment. The Reading Teacher, 1977, 11, 240-44.

Jenkins, J. R., & Heliotis, J. G. Reading comprehension instruction: Findings from behavioral and cognitive psychology. Topics in Language Disorders, 1981, 1, 25-41.

Kameenui, E., & Carnine, D. An investigation of the ecological validity of fourth graders' comprehension of pronoun constructions. Reading Research Quarterly, 1982, 17, 556-580.

Rosenshine, B. Classroom instruction. In N. L. Gage (Ed.), Psychology of teaching: The 77th yearbook of the National Society for the Study of Education. Chicago: National Society for the Study of Education, 1976.

Rosenshine, B. V., & Berliner, D. C. Academic engaged time. British Journal of Teacher Education, 1978, 4, 3-16.

Ross, D., & Carnine, D. W. Analytic assistance: Effects of example selection, subjects' age, and syntactic complexity. Journal of Educational Research, 1982, 75, 294-298.

Singer, H. & Donlan, D. Active comprehension: Problem solving schema with question generation for comprehension of complex short stories. Reading Research Quarterly, 1982, 2, 166-186.

Stevens, R. & Rosenshine, B. Advances in research on teaching. Exceptional Education Quarterly, 1981, 2, 1-10.

Footnotes

1. A study by Kameenui, Carnine, & Maggs (1980) was explicitly designed to look at the importance of teaching preskills (entry e in Table 1). Students were taught to translate a passive voice sentence into an active form. Students were also shown how to make two simpler sentences from a complex sentence with a clause. After learning these preskills, according to the procedures in Table 6, students responded to comprehension questions based on entire passages, which contained clause and passive voice constructions. Students performance on the comprehension questions improved markedly after preskill teaching.

2. While educators have widely differing opinions about the merits of scripted lesson plans like those found in Direct Instruction programs, the specificity is quite useful for research purposes (See, for example, Gall, 1977.) Scripted lesson plans, which include specifications for pacing, tasks, questions, correcting errors, and cueing students to respond, can contribute to fidelity of treatment. Research on text structure, meta-cognitive strategy instruction, or skill training can be compromised by variability in the way experimenters present the material, or carry out skill training. For example, if experimenters are asked to create their own examples, the quality of some of the examples may be inadequate. Similarly if the teacher wording is improvised, some may be unclear. With a script, these problems are eradicated. Thus, the findings in the teacher effectiveness domain not only highlight some important teaching techniques but also call attention to the need to control the various aspects of experimental interventions that make up a program of research.